Consideration sets in online shopping environments: the effects of search tool and information load

José F. Parra a,*, Salvador Ruiz b,1

a University Miguel Hernández, Avda Universidad s/n, 03202 Elche, Spain
b University of Murcia, Facultad de Economía y Empresa, Campus Univ. de Espinardo, 30100 Murcia, Spain

A R T I C L E   I N F O

Article history:
Received 29 December 2007
Received in revised form 8 April 2009
Accepted 12 April 2009
Available online 19 April 2009

Keywords:
Consideration set
Consumer behavior
Shopping engines
Information load
Search tool

A B S T R A C T

This study examines the effects of two main characteristics of online shopping environments – search tool and information load – on the descriptive characteristics of consideration sets: size, dynamism, variety and preference dispersion. A controlled experiment using a simulated online store was conducted to test the hypotheses, manipulating the two factors, search tool (yes, no) and information load (high, low). The main task consisted of shopping for and purchasing a product in an online store. Results show that both information load and search tools transform the way in which consumers form their consideration sets, resulting in smaller, more stable, and more homogenous sets, integrated by more equally preferred alternatives. Interaction effects show that search tools enhance their effectiveness in high information load settings.

© 2009 Elsevier B.V. All rights reserved.

1. Introduction

Consumers’ shopping behavior at online stores may be different from that in traditional retail stores (Alba et al. 1997; Winer et al. 1997). The quantity and quality of individually customized information that the Internet can provide, with minimal effort and cost, can facilitate better decisions and can make the decision-making process more efficient (Peterson and Merino 2003; Widing and Talarzyk 1993). This greater access to information in online environments has a significant impact on how consumers form consideration sets (Hoffman and Novak 1996). However, while online stores offer consumers greater choice and convenience, finding products or brands that match needs may not be an easy task. If deciding which products or brands should be included in the consideration set becomes too difficult, consumers may abandon the online store, either to search in another online store or to abandon the decision process.

Consideration set formation is a central stage of consumer decision-making that is attracting increasing academic and managerial attention (Alba et al. 1991; Paulsen and Bagozzi 2005; Posavac et al. 1997). The purchase decision is restricted to the brands in the consideration set (Nedungadi 1990), and it is critical for marketers to understand the process of consideration set formation, both to get their brand included in the set and to know which brands represent competition (Desai and Hoyer 2000). The size, dynamism, variety and preference dispersion are descriptive characteristics of consideration sets that provide information about how much effort it would suppose for consumers to choose from a consideration set and how difficult it would be for an alternative to enter or remain in that set (Desai and Hoyer 2000).

In a theoretical contribution, Peterson and Merino (2003) suggested that consideration sets of Internet users in pre-purchase information searches will be smaller and more homogeneous than the consideration sets of consumers who do not use the Internet. Research has shown that the size of the consideration set is lower when a decision aid is used (Häubl and Trifts 2000). Häubl and Trifts (2000) used a recommendation agent that assisted consumers in the initial screening of the alternatives, yielding smaller consideration sets and consumer effort than when the agent was not provided. However, the analysis of other consideration set characteristics, such as homogeneity, is also important to understand online consumer decision making. But research has not yet analyzed these other consideration set characteristics in online shopping environments, which is what we address in this paper.

The availability of search tools and the information load have been pointed out as being critical factors that have great potential to change how consumers screen alternatives in online shopping environments (Peterson and Merino 2003). Alba et al. (1997) highlighted electronic screening as the most important development in online shopping because it allows consumers to reduce the processing effort required to find the alternatives that match their preferences. At the same time, Internet vendors can control amounts of information about their products and consumers can access...
information about a large number of alternatives and a vast amount of information about each alternative (Hoffman and Novak 1996). However, the literature has not yet addressed how these two factors and their interaction affect to the consideration set characteristics.

In order to fill these gaps in the literature, this paper examines the effects of the use of a search tool and information load (amount of information about alternatives and attributes) on the characteristics of consideration sets. The paper is organized as follows. First, we briefly review the relevant literature on consideration sets in online shopping environments. We then develop a set of hypotheses for the effects of two properties of websites – presence of a search tool and information load – on the characteristics of consideration sets. This is followed by a description of the methodology used to test these hypotheses. Next, we report the results of our empirical study. The paper concludes with a discussion of the findings and suggestions for future research.

2. Consideration sets in online environments

Consumers are often unable to evaluate all available alternatives in great depth prior to making a choice because of the high cognitive processing demands that occur in situations with a lot of information and/or many alternatives. In these situations, the consumer purchase-decision process includes screening and evaluation phases. First, the consumer screens the large number of alternatives on salient attributes to arrive at a more manageable and relevant set. Next, the reduced set of alternatives is evaluated in more depth in order to make a purchase decision (Gensch 1987). Based on this, consideration sets are generally treated as those alternatives which a consumer considers seriously when making a purchase decision (Hauser and Wernerfelt 1990; Roberts and Lattin 1991).

When a brand enters the consideration set of a consumer, it is assigned a probability of being chosen, even if it is not the most preferred (Andrews and Srinivasan 1995), that is unless an item is included in the set, it will not be chosen (Nedungadi 1990). Managerially, the study of consideration set composition can help determine which products will compete against each other in a particular usage situation (Desai and Hoyer 2000).

In the screening phase of any decision-making process, the knowledge concerning the alternatives for consideration set development may be both memory-based and stimulus-based (Lynch et al. 1988). Consumers make frequent use of the Internet to conduct external information searches (Shim et al. 2001), a stimulus-based activity, in order to narrow down a large number of alternatives to a smaller consideration set. Interactive decision aids such as search tools of online shopping environments assist consumers in the initial screening of available alternatives to form their consideration sets (Alba et al. 1997; Häubl and Trifts 2000). The availability of these interactive utilities leads to a shift in emphasis from memory-based to stimulus-based purchase decisions, because retaining specific attribute information about relevant alternatives in memory becomes less important (Alba et al. 1997; Peterson and Merino 2003).

The characteristics of consideration sets (size, dynamism, variety, and preference dispersion) provide information about how the set is configured. The analysis of these characteristics allows a better understanding of how consumers make their final decision from the items included in the consideration set. Traditionally, one of the most interesting aspects of the consideration set is the number of alternatives that it is composed of. The size of a consideration set is a condition that limits the consumer’s tasks and processes involved in the decision process. The smaller this set size, the easier the consumer choice (Posavac et al. 1997). Additionally, it has been suggested that consideration sets evolve dynamically both within and across usage occasions. During the decision process, this characteristic represents how the composition of the consideration set changes as it is being formed (Shocker et al. 1991). The consideration set is constructed during the search process, and brands for which there is a high level of information uncertainty are not eliminated early on in the process, as they could turn out to have a higher expected utility if more information becomes available about them (Roberts and Lattin 1997). A third characteristic, the variety of the consideration set, refers to the extent to which items in a set are different in consumers’ perceptual space (Roberts and Lattin 1997). This concept has been studied from different perspectives: typicality of set items (Johnson and Lehmann 1997), across-category consideration of items from distinct nominal categories (Ratneshwar et al. 1996), and the variety of alternatives included in the set in terms of the situations in which they are used or the goals they satisfy (Desai and Hoyer 2000; Srivastava et al. 1984). A fourth characteristic, preference dispersion, refers to the unequal preference given to items in a set. This measure can be high when one or two alternatives are preferred over others, and low when preferences among set items are relatively equal (Bettman et al. 1998).

3. Effects of online search tools on consideration set characteristics

Online shopping environments include decision aids such as search tools and recommendation systems. The former assist consumers in the initial screening of the alternatives available in an online store while the latter selects one or more candidates from a set of alternatives through a filtering process based on the profile of the user (McGinty and Smyth 2006; Wang and Benbasat 2008) on other consumers’ choices (Ijima and Ho 2007; Zeng et al. 2004) or on the recommender’s knowledge about the product domain (Felfernig et al. 2006).

A search tool can sort through a vast number of alternatives and find those few that closely match the consumer’s utility function. It allows shoppers to screen a large set of alternatives in a systematic and efficient manner, mainly reducing the search cost (Bakos 1997; Kamis 2006; West et al. 1999) because the consumer does not have to examine products with a low probability of being chosen (Häubl and Trifts 2000). The consumer then expands search effort only in inspecting and evaluating the items recommended by the search tool, but is able to choose from amongst the best, as if the consumer had searched exhaustively through the entire inventory of the online store (Diehl et al. 2003). In a related study, Lynch and Ariely (2000) found that the reduction in search costs of quality information reduced price sensitivity under certain conditions.

In short, research findings support the propositions of Alba et al. (1997) about the usefulness of search tools in online purchase decisions. In order to expand this body of knowledge, this study focuses on how a search tool operating within a particular online store affects the characteristics of the consideration set. Through the development and testing of hypotheses regarding these effects, we will gain a greater understanding of how this search tool affects consumer behavior during the consideration set formation.

3.1. Consideration set size

Consideration set size reflects trade-offs between the marginal benefits and costs of considering additional alternatives (Hauser and Wernerfelt 1990; Roberts and Lattin 1991). The search tool allows consumers to specify the desired attribute levels. Each particular consumer can then examine only those alternatives that match all such attribute criteria he/she has specified. There are two effects associated with the use of search tools. First, using this interactive tool provides information about the relative utility of available
alTERNatives prior to processing information about those alternatives (Häubl and Trifts 2000). Consumers obtain two groups of alternatives: those selected by the search tool with a known relative utility, since they accomplish the search criteria, and the remaining alternatives with lower levels of relative utility (Moomthy et al. 1997). Thus, when using the search tool, the marginal benefit of including additional alternatives in the consideration set is lower than in a situation where this tool is not available. Second, the search tool allows consumers to screen alternatives instantaneously on one, some, or all of the available attributes; this is likely to happen because the costs of screening on many or few attributes is the same (Alba et al. 1997). Nonetheless, the greater the number of attributes a consumer uses to screen alternatives, the lower the number of alternatives that will be evaluated (Widing and Talarzyk 1993). In conclusion, consumers who use the search tool will have smaller consideration sets than those who do not, because of (a) the lower relative utility of those alternatives that have not been selected by the tool, and (b) the selectivity of the search tool:

H1. Use of the search tool leads to a reduction in the consideration set size.

3.2. Consideration set dynamism

As consumers search through information, alternatives may enter and leave the consideration set (Nedungadi, 1990; Shocker et al. 1991). Consumers may change the attributes used to evaluate the alternatives, as they proceed from the initial to the final stages of the decision process (Park and Lutz 1993). This change may imply that some of the alternatives already selected do not accomplish the new criteria (and are removed) while the opposite may happen to other alternatives not included in the consideration set. This is highly probable in off-line environments, because the screening of alternatives is usually based on one or very few attributes (Roberts and Lattin 1991). The screening may also be progressive, starting from one attribute and adding attributes in the following steps to either reduce the number of alternatives, or simply by changing the selection criteria as a consequence of the knowledge acquired during the screening experience. In contrast, in online environments the search tool allows the screening of alternatives by considering many attributes simultaneously, since introducing additional criteria (attributes) in the search conditions of the search tool does not require additional effort (Alba et al. 1997). Therefore, consumers will change fewer attributes and criteria to form a consideration set when they are using a search tool, compared to when they are not using this website tool. Performing such a restrictive search implies that few alternatives will enter the consideration set and very few will be dropped during the consideration set development. As a result, we expect that consumers who use the search tool will have less dynamic consideration sets than those who do not:

H2. Use of the search tool leads to a reduction in the dynamism of consideration set development.

3.3. Consideration set variety

Similarity among alternatives increases with the number of features common to all of the alternatives in the set, and decreases with the number of features particular to each alternative (Tversky 1977). A search tool allows consumers to look for alternatives that match their criteria on numerous attributes very easily, thus resulting in homogeneous levels for many attributes (Alba et al. 1997), especially those introduced in the search tool to select the alternatives. For this reason, the variety of alternatives in the consideration set will be lower when using a search tool than when not using this tool:

H3. Use of the search tool leads to a reduction in the variety of consideration set composition.

3.4. Preference dispersion of the consideration set

Search tools produce a smaller list of alternatives with less dispersion of the values of the attributes used as criteria during the search. This lower level of dispersion of the alternatives implies more similar levels of utility for each alternative than when the consumer does not use a search tool. When a consumer does use a search tool, the alternatives with low levels on the most relevant attributes are not included in the consideration set. Therefore, the use of the search tool produces a set that does not include alternatives with low preference levels. Consequently, items in the set will be more similarly preferred:

H4. Use of the search tool leads to a reduction in the preference dispersion of a consideration set.

4. The effects of information load on consideration set characteristics

Online shopping environments allow vendors to offer large amounts of information about their products (Hoffman and Novak 1996) and consumers can access information about a large number of alternatives and a vast amount of information about each alternative. Both the number of attributes and the number of alternatives are factors in the decision environment that make the decision task more complex (Payne 1982). As the number of alternatives and attributes per alternative increases, the processing activity of the consumer and the decision quality increases up to a certain point, after which the processing activity and decision quality begin to decrease (Payne et al. 1993). Consideration set formation is the result of consumer information processing and, consequently, the characteristics of the consideration set will also be affected by the amount of information available to make that decision.

4.1. Consideration set size

As information load (number of attributes and alternatives) increases, the effort required to make a decision increases and consumers attempt to use simplifying heuristics (Payne et al. 1993; Swait and Adamowicz 2001), for example, examining each alternative by processing multiple attributes (Helgeson and Ursic 1993). Using multiple attributes to screen alternatives reduces the number of alternatives that match the desired level on each attribute. If the number of alternatives that pass the screening is low, then the probability of any alternative entering the consideration set is low (Hauser and Wernerfelt 1990).

Conversely, in a decision environment with low information load (attributes and alternatives), subjects will use fewer attributes in the screening process. As there are few alternatives, using one or two attributes will be enough to obtain a manageable number of alternatives seriously considered for purchase. Additionally, because of the cognitive effort required to examine each attribute (Bettman et al. 1998), consumers will also tend to use fewer attributes. As a result of a screening based on few attributes, a greater number of alternatives will be considered acceptable and will be left for further evaluation, as compared to a situation with
multi-attribute screening. In short, an increase in information load reduces the consideration set size due to the use of the simplifying decision strategy described above:

**H5.** An increase in information load leads to a reduction in the consideration set size.

4.2. Consideration set dynamism

Alternatives can be subtracted from the consideration set during the development process. For instance, there may be a change in the consumer evaluation of a specific alternative brought about by the inclusion of an alternative that increases the overall utility to the point where the previous alternative drops out (Hauser and Wernerfelt 1990). This is possible because alternatives are examined sequentially (Roberts and Lattin 1991) and the utility of each alternative compared to other alternatives that are yet to be examined is not known.

Simplifying heuristics are more likely to be used when developing consideration sets in a high information load environment (Payne et al. 1993). One such heuristic is to examine each alternative on multi-attribute criteria (Helgeson and Ursic 1993). As a result, the consumer is able to determine better the relative utility of the alternatives included in the consideration set, and it is therefore highly unlikely that any alternative is removed from the set. Thus, the consideration set formation will be less dynamic in a high information load decision environment:

**H6.** An increase in information load leads to a reduction in the dynamism of consideration set development.

4.3. Consideration set variety

Consideration sets are more likely to be composed of products with similar utility values than products with dissimilar ones (Lehmann and Pan 1994). In off-line environments, during the consideration set development, alternatives are screened based on a few attributes (Roberts and Lattin 1991) and only the alternatives that match the preferred attributes or features of a product are chosen to achieve various consumer goals (Ratneshwar et al. 1996; Shocker et al. 1991). Alternatives included in the consideration set are then likely to exhibit homogeneity for the attributes used for the screening, but will tend to be heterogeneous on attributes that were not used for screening. Thus, it is likely that the consideration set will contain highly differentiated alternatives (Shocker et al. 1991) as a result of the few attributes used in the selection process. This depiction of the evolution of consideration sets highlights that the number of attributes used to form the consideration set determines the variety of its composition. As we noted earlier, in a decision environment with high information load (attributes and alternatives) environment, consumers examine each alternative on multi-attribute criteria (Helgeson and Ursic 1993), expending more effort during the screening phase in order to simplify the decision task and to eliminate less preferred alternatives early in the decision process. This change in the decision strategy shows that the increase in information load leads consumers to screen alternatives more carefully. Alternatives are then more likely to be included in the consideration set because they match consumer preferences rather than because they are more accessible in the decision environment or in consumers’ memories. Additionally, preferences among the consideration set items will be more similar when they are chosen as a result of their evaluation on many attributes than when alternatives are chosen based on their accessibility. Therefore, the greater the information load, the more homogeneous the preferences for the items included in the consideration set will be.

**H7.** An increase in information load leads to a reduction in the variety of consideration set composition.

4.4. Preference dispersion of the consideration set

Preference dispersion among the alternatives included in the consideration set can vary depending on both consumer evaluation and the salience of each alternative in either memory or the decision environment (Desai and Hoyer 2000). For instance, Nedungadi (Nedungadi 1990) showed that without influencing a brand’s evaluation, the probability of its choice could be increased merely by enhancing its probability of retrieval. Similarly, Posavec et al. (1997) suggested that if the importance of the decision is low, as in low involvement buying decisions, consumers are likely to consider less preferred alternatives simply because these may be more accessible, either in their memory or in the decision environment.

When developing consideration sets in a high information load (attributes and alternatives) environment, consumers examine each alternative on multi-attribute criteria (Helgeson and Ursic 1993), expending more effort during the screening phase in order to simplify the decision task and to eliminate less preferred alternatives early in the decision process. This change in the decision strategy shows that the increase in information load leads consumers to screen alternatives more carefully. Alternatives are then more likely to be included in the consideration set because they match consumer preferences rather than because they are more accessible in the decision environment or in consumers’ memories. Additionally, preferences among the consideration set items will be more similar when they are chosen as a result of their evaluation on many attributes than when alternatives are chosen based on their accessibility. Therefore, the greater the information load, the more homogeneous the preferences for the items included in the consideration set will be.

**H8.** An increase in information load leads to a reduction in the preference dispersion of the consideration set.

5. Interaction effects of search tool and information load on consideration set characteristics

Häubl and Trifts (2000) suggested that decision aids could have more impact on the decision process under conditions of high information load. In web shopping environments with high amounts of information, consumers may be more eager to use screening tools in order to easily obtain a set of alternatives that match their preferences. In addition, as the costs of using many or few attributes when screening through a search tool is very similar (Alba et al. 1997), it is more likely that consumers will use search criteria based on more attributes. This will imply a lower number of alternatives that will be evaluated, and thus considered (Widing and Talarzyk 1993).

Moreover, using more product attributes in a search tool may lead to less dynamic consideration sets. This is because we can expect that few alternatives will enter the consideration set and very few will be dropped during the consideration set development. On the other hand, more search criteria also imply more homogeneous levels for many attributes (Alba et al. 1997) and hence less variety in the alternatives considered. Finally, a smaller list of alternatives with more homogenous levels for their attributes may result in consideration sets integrated by more similarly preferred alternatives.

In summary, an increase in the information load will favour, if available, a more intense use of the search tool so as to manage the higher amount of information available. As such, this will result in smaller consideration sets, based on lower dynamism, and composed of more homogenous and more equally preferred alternatives.

**H9.** An increase in information load leads to a greater effect of the search tool on the reduction of consideration set size, dynamism, variety and preference dispersion.
6. Method

A controlled experiment was conducted to test the above hypotheses for the effects of search tool and information load on the characteristics of the consideration set. The main task in the experiment consisted of shopping for and purchasing a product in an online store. A 2 × 2 between subjects design was used. The manipulated factors were search tool (yes, no) and information load about attributes and alternatives (high, low). A total of 366 students participated in the study and were randomly assigned to one of the four conditions. The average age of the participants was 22 years, and 45% were males and 55% females.

Profiles for 80 stereo systems were constructed (8 models for each of the 10 brands). Real brand names were used. All model names were fictitious but representative of the product category. Each alternative was described by 21 attributes in addition to brand and model name. The selection of attributes to configure the profiles was based on the analysis of past studies that used this product category (Häubl and Trifts 2000) and real online audio stores. For a given profile, the product description was created through a fractional factorial design. Unrealistic and dominated alternatives were removed. A scenario situation was used which described a future event in which the subject was planning to buy a stereo system. The task scenario informed subjects that they were to put together a list of alternatives that they would seriously consider as purchase options.

Data were collected in a university computer lab in sessions of 10 to 15 subjects. Before the start of the experiment, subjects were informed about a lottery incentive and were shown the features of the shopping environment in a training session. The lottery incentive offers the chance to win a stereo system or its price in cash. We held a public raffle that had previously been announced to all the participants. They were also asked to rate their level of product category knowledge and interest (using seven-point rating scales). Then they read a description of the task. Subjects who used the search tool started by providing desired attribute levels for all attributes according to their preferences. All alternatives that met or exceeded the cut-offs were displayed. The number of alternatives remaining after a search was also indicated at the top of the screen. The subject could then either select one or more alternatives by putting the alternative in a “basket of products seriously considered for purchase” or change one or all the search criteria and perform a new search. Subjects could repeat their search as many times as they needed. Subjects in the no-search tool conditions were provided with the entire list of stereo systems so that they could select those alternatives to be included in the basket. The information load factor had two levels (high vs. low), according to the number of alternatives and attributes available to complete the experimental task. The criteria used to determine the number of alternatives and attributes was based on observations in the marketplace and previous research (Häubl and Trifts 2000; Widing and Talarzyk 1993). In the high information load condition, the number of available alternatives was set at 80, with each one described by 23 attributes. For the low information load condition, thirty alternatives and nine attributes per alternative were used. The web sites of these four experimental conditions are shown in the Appendix. Subjects required 16 min on average to navigate the online store and complete the shopping decision.

Alternatives were displayed in random order under all conditions. The consideration set size consisted of those alternatives that had been placed in the electronic “basket of products seriously considered for purchase” at the conclusion of the task. Based on Hauser and Wernerfelt (Hauser and Wernerfelt 1990), the consideration set was measured as “those products that would be seriously considered for purchase”, that is, those that subjects had in the basket at the end of the task. The dynamic nature of the consideration set is assessed as an index that reflects how the composition of the consideration set changes during the decision process (Shock et al. 1991). We constructed an index that takes into account the number of alternatives that enter and are deleted from the consideration set divided by the final size of the set. The closer this number is to zero, the lower the set dynamism. Similarity-based judgments (Johnson and Lehmann 1997) are used to measure the perceived variety in the composition of the consideration set. Subjects rated the similarity of each possible pair of alternatives composing their consideration set. The pairs were rated on a scale from 0 (very dissimilar) to 10 (very similar). Consideration set variety was then measured as the average similarity rating of the different pairs of alternatives included in the set. Finally, preference scores were also measured using an 11-point rating scale. The standard deviation of preference scores depicted preference dispersion in the set (Desai and Hoyer 2000). The closer this number is to zero, the lower the set dispersion.

After completing their shopping experience, subjects responded to manipulation-check questions, using a seven-point rating scale. First, in order to check the search tool manipulation, they expressed how easy it was to locate the products that best matched their personal preferences on a scale from 1 (very difficult) to 7 (very easy). The information load condition was checked by asking subjects about how much information was available on the website on a scale from 1 (very little) to 7 (very much).

7. Results

7.1. Manipulation check

Manipulation was checked through one-way ANOVAs. Analyses showed that information load and search tool were successfully manipulated. Subjects perceived that more information was available on the website in the high information load condition, compared to the low information load condition ($M_{low} = 4.79$ vs. $M_{high} = 5.43$; $F(1, 364) = 22.88, p < 0.01$). Similarly, subjects express less difficulty in locating products that best matched their preferences when the search tool was present than when not ($M_{SA yes} = 5.50$ vs. $M_{SA no} = 4.62$; $F(1, 364) = 40.55, p < 0.01$).

7.2. Analysis method

The frequencies of consideration set size in each condition are shown in Table 1. A GLM was used as the primary analysis tool to test the hypotheses regarding the effects of the search tool and the information load (number of attributes and alternatives). The following predictor variables were included in these models: main effects for search tool and information load, plus the search tool × information load interaction effect. Effects on variety (hypotheses 3 and 7) were tested using an independent ANCOVA.

---

2 A large number of stimuli (alternatives and attributes) were used because phased decision strategies with a consideration set phase and a choice phase are likely to occur when the information load is high (Gensch 1987; Payne et al. 1993).
in order to prevent data loss, as variety was measured only when the consideration set was composed of two or more alternatives.

As no time limitations were set on the experiment, the navigation time was entered in the models (both GLM and ANCOVA) as a covariate in order to eliminate the influence caused by this variable on the dependent variables. Product knowledge and interest were also introduced in these models, but as they were not significant, we removed them for all subsequent analyses.

Considering the large sample size and the robustness of MANCOVA and ANCOVA to departures from multivariate normality (Swait and Adamowicz 2001), violations of multivariate normality are not expected to be severe. Moreover, as MANCOVA assumes linear relationships between all pairs of dependent variables in each cell, we plotted the dependent variables and obtained a clear indication of linear relationships. Correlations between dependent variables were also significant (Table 2).

Research concerning the robustness of the statistics available for MANCOVA has proposed that the Pillai–Bartlett trace criterion (Tabachnik and Fidell 1996). The results of this test indicate significant results for the interaction effect ($V = 0.04$, $F(3, 359) = 4.47$, $p < 0.01$), as well as significant effects for search tool ($V = 0.348$, $F(3, 359) = 61.19$, $p < 0.01$), and information load ($V = 0.25$, $F(3, 359) = 40.47$, $p < 0.01$). The main effect of the covariate “navigation time” is also significant ($V = 0.12$, $F(3, 359) = 16.83$, $p < 0.01$).

7.3. Test of hypotheses

We used univariate analyses to check our hypotheses. The results of the ANCOVA tests are shown in Table 3, and the means are shown in Table 4. Results show that the effect of the search tool on the consideration set size is highly significant ($F(1, 361) = 72.54$, $p < 0.01$) and in the expected direction. Inspection of the marginal means shows that the use of the search tool leads to smaller consideration sets, which provides support for H1. The average number of alternatives seriously considered for purchase was 2.77 in the search tool condition, and 4.41 in the no-search tool condition. Hypothesis H2 posits that the consideration set development will be less dynamic using the search tool. The main effect for this factor was significant ($F(1, 361) = 23.72$, $p < 0.01$) and results show that consideration set development was more dynamic when the search tool was not used (1.35) than when it was (0.31). Therefore H2 is supported. Results also show that the effect of search tool on variety is highly significant ($F(1, 312) = 38.43$, $p < 0.01$) and provide

### Table 1

Frequencies of consideration set size.

<table>
<thead>
<tr>
<th>Consideration set size</th>
<th>Search tool</th>
<th>Information load</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>1</td>
<td>41</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>40</td>
<td>15</td>
</tr>
<tr>
<td>3</td>
<td>56</td>
<td>43</td>
</tr>
<tr>
<td>4</td>
<td>25</td>
<td>38</td>
</tr>
<tr>
<td>5</td>
<td>15</td>
<td>35</td>
</tr>
<tr>
<td>6</td>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>More than 7</td>
<td>2</td>
<td>14</td>
</tr>
<tr>
<td>Total sample</td>
<td>183</td>
<td>183</td>
</tr>
</tbody>
</table>

### Table 2

Correlations between dependent variables.

<table>
<thead>
<tr>
<th></th>
<th>Information load</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High</td>
</tr>
<tr>
<td>Search tool: yes</td>
<td>Css</td>
</tr>
<tr>
<td>Consideration set size (Cs)</td>
<td>$-0.10$ (n.s.)</td>
</tr>
<tr>
<td>Consideration set dynamism (Cs)</td>
<td>$-0.11$ (n.s.)</td>
</tr>
<tr>
<td>Consideration set preference dispersion (Csp)</td>
<td>0.78 ***</td>
</tr>
<tr>
<td>Search tool: no</td>
<td>Ccc</td>
</tr>
<tr>
<td>Consideration set size (Cs)</td>
<td>$-0.41$ ***</td>
</tr>
<tr>
<td>Consideration set dynamism (Cs)</td>
<td>$-0.22$ ***</td>
</tr>
<tr>
<td>Consideration set preference dispersion (Csp)</td>
<td>0.18 ***</td>
</tr>
</tbody>
</table>

*p < 0.10.
**p < 0.05.
***p < 0.01.

### Table 3

Results of ANCOVA tests.

<table>
<thead>
<tr>
<th>Hypotheses</th>
<th>Dependent variables and effects</th>
<th>F</th>
<th>p</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consideration set size</td>
<td>H1 Search tool (ST)</td>
<td>72.54</td>
<td>0.00</td>
<td>0.15</td>
</tr>
<tr>
<td>H5 Information load (IL)</td>
<td>28.33</td>
<td>0.00</td>
<td>0.05</td>
<td></td>
</tr>
<tr>
<td>H9 ST × IL Navigation time (covariate)</td>
<td>1.73</td>
<td>0.20</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>Consideration set dynamism</td>
<td>H2 Search tool (ST)</td>
<td>23.72</td>
<td>0.00</td>
<td>0.05</td>
</tr>
<tr>
<td>H6 Information load (IL)</td>
<td>22.81</td>
<td>0.00</td>
<td>0.05</td>
<td></td>
</tr>
<tr>
<td>H9 ST × IL Navigation time (covariate)</td>
<td>4.80</td>
<td>0.02</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>Consideration set variety</td>
<td>H3 Search tool (ST)</td>
<td>38.43</td>
<td>0.00</td>
<td>0.10</td>
</tr>
<tr>
<td>H7 Information load (IL)</td>
<td>26.05</td>
<td>0.00</td>
<td>0.06</td>
<td></td>
</tr>
<tr>
<td>H9 ST × IL Navigation time (covariate)</td>
<td>9.09</td>
<td>0.00</td>
<td>0.03</td>
<td></td>
</tr>
<tr>
<td>Preference dispersion</td>
<td>H4 Search tool (ST)</td>
<td>39.30</td>
<td>0.00</td>
<td>0.08</td>
</tr>
<tr>
<td>H8 Information load (IL)</td>
<td>37.84</td>
<td>0.00</td>
<td>0.08</td>
<td></td>
</tr>
<tr>
<td>H9 ST × IL Navigation time (covariate)</td>
<td>0.09</td>
<td>0.10</td>
<td>0.00</td>
<td></td>
</tr>
</tbody>
</table>

### Table 4

Cell means.

<table>
<thead>
<tr>
<th>Dependent variables</th>
<th>Search tool</th>
<th>Information load</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Consideration set size</td>
<td>2.77</td>
<td>4.41</td>
</tr>
<tr>
<td>Consideration set dynamism</td>
<td>0.31</td>
<td>1.35</td>
</tr>
<tr>
<td>Consideration set variety</td>
<td>2.84</td>
<td>3.71</td>
</tr>
<tr>
<td>Preference dispersion</td>
<td>1.05</td>
<td>1.66</td>
</tr>
</tbody>
</table>
support for H3. Variety of consideration set composition was 2.84 when respondents used the search tool and 3.71 when they did not. ANCOVA also provides support for H4. Results revealed a significant effect ($F(1, 361) = 39.30, p < 0.01$) in the expected direction. Preference dispersion was lower in the search tool conditions than in the no-search tool conditions (1.05 vs. 1.66, respectively).

Information load (the number of attributes and alternatives) was also found to reduce consideration set size. The average number of alternatives seriously considered for purchase was 3.99 in the low information load condition and 3.19 under high information load. This effect was highly significant ($F(1, 361) = 28.33, p < 0.01$) and provides support for H5. The effect of information load on consideration set dynamism (H6) is also significant ($F(1, 361) = 22.81, p < 0.01$). High information load led to a reduction in the degree of dynamism of the consideration set (1.17 vs. 0.49, for high and low information load respectively). The effect of information load on variety of consideration set composition is significant ($F(1, 312) = 26.05, p < 0.01$) and in the expected direction. Variety is greater when information load is low (3.76) than when it is high (2.81), supporting H7. Finally, H8 posited smaller preference dispersion in sets derived from high rather than low information load environments (those with a low number of attributes and alternatives). Results showed a significant effect and provide support for H8 ($F(1, 361) = 37.84, p < 0.01$). Preference dispersion was smaller in high information load conditions (1.05) than in low information load conditions (1.66).

H9 posited interaction effects between search tool and information load (number of attributes and alternatives). While this interaction is not significant for consideration set size, there is a significant interaction for dynamism. The effect of information load is significant for both the search tool condition ($F(1, 180) = 15.94, p < 0.01$) and the no search tool condition ($F(1, 180) = 14.28, p < 0.01$), given the significant interaction that is also present for this variable ($F(1, 361) = 4.80, p < 0.05$). Inspection of the marginal means reveals a lower consideration set dynamism when the search tool condition is available (see Fig. 1). For variety, the interaction between search tool and information load is also significant ($F(1, 312) = 7.40, p < 0.01$). Similarly, the increase in information load reduces consideration set variety when the subject uses a search tool ($F(1, 139) = 30.09, p < 0.01$), while it remained unchanged in the absence of a search tool ($F(1, 172) = 2.50, p = 0.11$). Finally, significant interaction for preference dispersion ($F(1, 361) = 11.53, p < 0.01$) reveals a reduction in preference dispersion, as a consequence of information load, under the search tool condition ($F(1, 180) = 65.21, p < 0.01$). For the no search tool condition, the effect of information load on preference dispersion is not significant ($F(1, 180) = 2.06, p = 0.15$). Overall, this interaction effects show that the search tool condition moderates the effects of information load on dynamism, variety and preference dispersion (see Figs. 1–3). Hence, H9 is partially supported by the data (see Figs. 4–7).

8. Discussion

Earlier research on consideration sets has focused on the size and composition, primarily in the context of memory sets. In this study, we analyze Desai and Hoyer’s descriptive characteristics of consideration sets (Desai and Hoyer 2000) in an online shopping environment, where the presence of interactive decision aids and amount of information available may result in a shift in emphasis from memory-based to stimulus-based processing in the screening of the alternatives to be considered in the purchase decision (Alba et al. 1997).

A characteristic feature of electronic shopping environments is the vast amount of information available when making purchase decisions. In many cases, online shopping environments provide consumers with interactive search tools to help them access prod-
Fig. 4. No search tool and low information load.

Fig. 5. Search tool and low information load.
uct information effectively. These characteristics determine the initial screening of alternatives in online shopping environments and make the screening process fundamentally different from that in traditional retail stores. From a consumer perspective, having access to a very large number of alternatives with detailed attribute information about each alternative is highly desirable, and the use of interactive decision aids, such as search tools, enable consumers to manage this vast quantity of information available in electronic shopping environments.

The objective of this study was to examine the effects of search tools and information load about attributes and alternatives on consideration sets in an online shopping context. In particular, we focused on the characteristics of consideration sets (size, dynamism, variety and preference dispersion). Results show that both information load and search tools transform the way in which consumers form their consideration sets, resulting in smaller, more stable, and more homogenous sets, integrated by alternatives more equally preferred. The use of a search tool allows consumers to find their preferred products very easily, while expending substantially less effort than without a search tool. These results support the preliminary suggestions and findings of Alba et al. (1997) and Häubl and Trifts (2000). A more efficient way of forming consideration sets derives from the use of a search tool, which greatly reduces the trade-off between effort and accuracy (Payne et al. 1993). In this situation, a very small effort (compared to what the consumer has to make when the search tool is not available) produces accurate results: (a) smaller consideration set sizes, (b) more stability, (c) more homogeneity, and (d) sets composed of alternatives with similar preference. Therefore, the consideration set obtained using of a search tool shows the alternatives that really compete for that consumer (or that market segment).

Moreover, we have demonstrated that an increase in information load (attributes and alternatives) yields smaller consideration sets. As pointed out by different authors, (Gensch 1987; Payne et al. 1993) the increase in information load favors two-step decision strategies (consideration and choice). As more attributes and alternatives contribute to increasing the complexity of the decision, consumers tend to reduce this complexity by filtering out a greater number of alternatives in the consideration step. This result is consistent with that obtained by Helgeson and Ursic (1993), who found that consumers attempt to use simplifying heuristics, such as examining each alternative by processing multiple attributes, when more information is available. Additionally, the consideration set becomes more stable and homogeneous as a store’s website information load increases. This greater homogeneity and stability requires consumers to evaluate alternatives more carefully when making the final purchase decision. In this situation, it is unlikely that an alternative will be removed from the consideration set as a result of the lower utility compared to the rest or the average (Hauser and Wernerfelt 1990).

Our findings also support the suggestions of Häubl and Trifts (2000) that decision aids have more impact on the decision process under conditions of high information load. This research shows that search tools enhance their effectiveness in high information load settings. In web shopping environments with large amounts of information, consumers may be more eager to use screening tools to obtain a more homogeneous consideration set with similar preference for the alternatives it contains. Web retailers may therefore benefit from incorporating search tools into their web sites, as consumers will prefer to obtain more consistent consideration sets with much less effort, compared to what they would obtain if the search tool were not available in a rich information environment. These tools are essential nowadays as most elec-
tronic shopping environments offer an infinite "shelf space" because of the lack of physical constraints with respect to product display, making it possible for vendors to provide detailed descriptions of products and a large assortment at a low cost.

A limitation of this study is that it was restricted to one electronic store. Real world consideration sets can include alternatives from competing online stores or they may be associated with a hierarchical decision process, such as first selecting one from a set of online stores and subsequently selecting a product from that store's offer. In this broader context, the richness of information of online shopping environments could be studied in more depth. Internet can provide consumers not only with a vast amount of information but also with a high information load.

Fig. 7. Search tool and high information load.
information about products, but also with a great diversity of sources where access is granted to both customers' and marketers' information about products. Additionally, we acknowledge that in this study we manipulated simultaneously the information load through the number of attributes and alternatives. Although both factors increase the decision task complexity and should have similar effects on the decision-making process (Payne et al. 1993), further studies could address this limiting factor and analyze the effects of the number of attributes and alternatives separately. Finally, another interesting avenue for future research is to analyze whether consideration set characteristics may depend on the results from the search tool (i.e. what is shown, how they are sorted), or the type of search tool implemented in the website.

Acknowledgement

The authors would like to thank Fundacion Cajamarucia for its generous support. This research was funded by the grant SEJ2005-09358/ECON from the Spanish Ministry of Science & Technology and FEDER.

Appendix Experimental conditions

1. No search tool and low information load.
2. Search tool and low information load.
3. No search tool and high information load.
4. Search tool and high information load.

References